

WHAT IS CLAIMED IS:

1. A computer-implemented method, comprising, receiving
load information corresponding to network load, at a source of
network packets, wherein the network load information is
5 determined by network traffic, and controlling a rate of a flow
of packets at the source based on the load information and a
weight value associated with the flow.

2. The method of claim 1 wherein the load information
10 comprises a load estimate computed by at least one router in the
path from the source to a destination node.

3. The method of claim 1 wherein the load information
15 comprises a combination of load estimates computed by at least
two routers in the path from the source to a destination node.

4. The method of claim 1 wherein the load information is
20 provided by at least one router in the path from the source to a
destination node.

5. The method of claim 4 wherein the load information is
placed by a router into a packet sent by the source, received at
the destination node, and returned to the source via another
packet from the destination node.

6. The method of claim 5 wherein the other packet comprises an acknowledge packet sent from the destination node to the source.

5 7. The method of claim 1 wherein controlling the rate of the flow of packets comprises adjusting the rate proportional to the weight value and inversely proportional to the load information.

10 8. In a computer network, a system comprising, a source of a flow of data, a destination node that receives at least some of the flow of data from the source, a router between the source and destination that is configured to compute network load and
15 associate load value information corresponding to the network load with the data, a mechanism configured to provide the value corresponding to the network load to the source, and the source including a mechanism that controls a rate of the flow of further data based on the value corresponding to the network load and a weight associated with the flow.

20 9. The system of claim 8 further comprising at least one other router between the source and the destination, and wherein the load value information of the router is adjusted by the other router before being provided to the source.

10. The system of claim 8 wherein the mechanism configured to provide the load value information is incorporated into the destination, and the load value information is provided to the source in a communication back from the destination the source.

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11. In a computer system connected to a computer network, a method comprising:

obtaining price information corresponding to network load at the computer system, the price information being determined by actual network traffic relative to network capacity; and

controlling a rate of transmitting data on the network based on the price information and a value representative of a willingness to pay.

12. The method of claim 11 wherein obtaining price information includes receiving the price information from another computer system on the network.

13. The method of claim 12 wherein the other computer system on the network determines the price information by measuring the actual network traffic as a fraction of the network capacity which can be served with low congestion.

14. The method of claim 13 wherein the fraction comprises a threshold value, and wherein the other computer system determines

the price information by measuring the actual network traffic,
and increasing a previous price if the actual network traffic
relative to network capacity is greater than a threshold value,
or decreasing the previous price if the actual network traffic
5 relative to network capacity is less than the threshold value.

15. The method of claim 14 wherein the other computer
system on the network increases the previous price by multiplying
the previous price by a first factor, and decreases the previous
price by multiplying the previous price by a second factor.

16. The method of claim 12 wherein the other computer
system broadcasts the price information.

17. The method of claim 12 wherein the other computer
system regularly updates the price information.

18. The method of claim 11 wherein controlling a rate of
transmitting data includes determining the rate based on the
20 willingness value divided by the price information.

19. The method of claim 11 wherein controlling a rate of
transmitting data includes, obtaining the value representative of
the willingness to pay for a selected application, and

controlling the transmit rate for the selected application based on that willingness value and the price information.

20. The method of claim 11 wherein controlling a rate of
5 transmitting data includes, obtaining the value representative of the willingness to pay for each of a plurality of selected applications, and for each application, controlling the transmit rate based on the application's respective willingness value and the price information.

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24. The method of 23 wherein a rate adjustment is smoothed based on the fraction of the network capacity being used by at least one application whose rate at least in part is not controlled according to price information.

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25. In a computer network, a system, comprising,
an observer mechanism that determines network demand;
a pricing mechanism configured to determine a price based on the network demand and network capacity data, the pricing mechanism further configured to provide price information corresponding to the price to at least one device on the network;
and

a rate control mechanism configured to receive the price information and to control at least one transmit rate based on the received price information.

26. The system of claim 25 wherein the observer mechanism is incorporated into a computing device on the network.

27. The system of claim 26 wherein the computing device comprises a router.

28. The system of claim 26 wherein the computing device comprises a gateway.

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29. The system of claim 26 wherein the pricing mechanism is incorporated into the same computing device as the observer.

30. The system of claim 25 wherein the pricing mechanism
5 provides price information by broadcasting the price information on the network.

31. The system of claim 30 wherein the pricing mechanism provides the price information at regular intervals.

32. The system of claim 25 wherein the pricing mechanism determines price information by dividing a value representative of the network demand by the network capacity data.

33. The system of claim 32 wherein the network capacity data comprises a fixed value.

34. The system of claim 32 wherein the network capacity is variable.

35. The system of claim 32 wherein the value representative of the network demand comprises a number of bytes of network traffic per unit time.

36. The system of claim 35 wherein the number of bytes includes packet overhead.

37. The system of claim 25 further comprising an application program, and wherein the rate control mechanism controls a transmit rate for the application based on a willingness to pay value associated with the application program and the received price information.

38. The system of claim 37 further comprising at least one other application that does not have its transmit rate controlled by the rate control mechanism.

39. The system of claim 37 wherein at least one application has its transmit rate comprised of a fixed amount not controlled according to the price information, and a rate based on the price and the application's respective willingness to pay.

40. The method of 39 wherein the price information being determined is based on a fraction of the network capacity being used by at least one application whose rate at least in part is not controlled according to price information.

41. The method of 40 wherein a rate adjustment is smoothed based on the fraction of the network capacity being used by at

least one application whose rate at least in part is not controlled according to price information.

42. The system of claim 37 wherein the pricing mechanism
5 determines the price information by comparing the network demand to a threshold value, and if the network demand achieves the threshold value, increasing a previous price, and if not, decreasing the previous price.

43. The system of claim 25 wherein the rate control
10 mechanism comprises protocol code implemented at the Internet Protocol (IP) layer.

44. The system of claim 25 wherein the rate control
15 mechanism controls the at least one transmit rate by controlling a rate of acknowledging packet receipt.

45. A computer-implemented method, comprising:
receiving a plurality of packets transmitted on a network
20 during a time interval;
determining a network demand value based on an accumulated size of the packets received during the time interval and a network capacity value;
determining a price value based on the network demand value
25 relative to a threshold;

providing the price value to a computing device on the network; and

at the computing device, controlling a rate of transmitting packets on the network based on the price.

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46. The method of claim 45 wherein receiving a plurality of packets includes operating a computing device in a mode that is intended to receive all packets transmitted on the network.

10 47. The method of claim 45 wherein determining a network demand value comprises calculating a current percentage of the network capacity in use.

15 48. The method of claim 45 wherein determining a price value comprises increasing a previous price if the threshold is achieved, else decreasing the price.

49. The method of claim 45 wherein providing the price value comprises broadcasting price information on the network.

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50. The method of claim 45 wherein controlling the rate of transmitting packets comprises, selecting an application program, obtaining a willingness value associated with the application program, and controlling the rate based the willingness value and
25 the price value.

51. The method of claim 45 wherein controlling a rate of transmitting packets on the network comprises controlling a rate of acknowledging the receipt of packets by the computing device.

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52. A computer-implemented method, comprising, receiving load information corresponding to network load at a destination of network packets, wherein the network load information is determined by network traffic, and controlling a rate of a flow of packets to the destination based on the load information and a weight value associated with the flow.

53. The method of claim 52 wherein controlling a rate of a flow of packets to the destination comprises controlling a rate of acknowledging packets received from a source.